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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/985,904	11/06/2001	Tomio Iwasaki	501.36931CX1	4536

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EXAMINER

SMOOT, STEPHEN W

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 06/27/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/985,904

Applicant(s)

IWASAKI ET AL.

Examiner

Stephen W. Smoot

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 9-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 3-6 is/are allowed.
- 6) ☒ Claim(s) 1, 2, 9 and 13-16 is/are rejected.
- 7) ☒ Claim(s) 10-12 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 November 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/255,856.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

This Office action is in response to applicant's RCE filed 11 June 2003.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's amendments filed on 12 May 2003 and on 11 June 2003 have been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-2 are rejected under 35 U.S.C. 102(e) as being anticipated by Schacham-Diamand et al. (from applicant's IDS filed on 06 November 2001).

Referring to Fig. 13, Schacham-Diamand et al. disclose an interconnect structure with copper wirings (33) (see column 9, lines 37-40) that have a neighboring catalytic seed layer (18a) that can be rhodium or platinum (see column 7, lines 29-35 and column 11, lines 21-22, 48-49) and a barrier layer (17a) that can be titanium nitride, tantalum, or tungsten (see column 6, lines 35-37, column 7, lines 26-28, and column 9, lines 16-17) adjacent to the catalytic seed layer (18a), all formed over a silicon substrate (see column 5, lines 13-32). These are all of the structural limitations set forth in claims 1-2 of the applicant's invention. Regarding the limitation in claim 1 of the neighboring film preventing voids due to electromigration of copper, it is noted that this limitation is inherent since MPEP section 2112.01 states "when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent."

4. Claim 9 is rejected under 35 U.S.C. 102(e) as being anticipated by Schacham-Diamand et al. (from applicant's IDS filed on 06 November 2001).

Referring to Fig. 13, Schacham-Diamand et al. disclose an interconnect structure with copper wirings (33) (see column 9, lines 37-40) that have a neighboring catalytic seed layer (18a) that can be rhodium or platinum (see column 7, lines 29-35 and column 11, lines 21-22, 48-49) and a barrier layer (17a) that can be titanium nitride,

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tantalum, or tungsten (see column 6, lines 35-37, column 7, lines 26-28, and column 9, lines 16-17) adjacent to the catalytic seed layer (18a), all formed over a silicon substrate (see column 5, lines 13-32). Referring to Fig. 20, Schacham-Diamand et al. further disclose that additional metal levels can be formed over the substrate using plugs (51) to couple the metal lines (52) (see column 10, lines 26-33). These are all of the limitations set forth in claim 9 of the applicant's invention.

5. Claims 13-16 are rejected under 35 U.S.C. 102(e) as being anticipated by Schacham-Diamand et al. (from applicant's IDS filed on 06 November 2001).

Referring to Fig. 13, Schacham-Diamand et al. disclose an interconnect structure with copper wirings (33) (see column 9, lines 37-40) that have a neighboring catalytic seed layer (18a) that can be rhodium or platinum (see column 7, lines 29-35 and column 11, lines 21-22, 48-49) and a barrier layer (17a) that can be titanium nitride, tantalum, or tungsten (see column 6, lines 35-37, column 7, lines 26-28, and column 9, lines 16-17) adjacent to the catalytic seed layer (18a), all formed over a silicon substrate (see column 5, lines 13-32). Referring to Fig. 20, Schacham-Diamand et al. further disclose that additional metal levels, separated by dielectric layers (55), can be formed over the substrate using plugs (51) to couple the metal lines (52) and the M1 level directly to the substrate (54) (see column 10, lines 26-33). Schacham-Diamand et al. also recognize that the dielectric material can be silicon dioxide (see column 5, lines 16-18). These are all of the limitations set forth in claims 13-16 of the applicant's invention.

Allowable Subject Matter

6. Claims 3-6 are allowed.
7. Claims 10-12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form to include all of the limitations of claim 9.
8. The following is a statement of reasons for the indication of allowable subject matter:
 - Claims 3-6 are allowed because the prior art of record does not teach or suggest, in combination with the other claim limitations, a semiconductor device having a layered interconnection structure that includes a platinum film and a neighboring film adjacent to the platinum film, wherein the neighboring film has as a primary constituent an element selected from rhodium, ruthenium, iridium, or osmium; and
 - Claims 10-12 would be allowable because the prior art of record does not teach or suggest, in combination with the other claim limitations, a semiconductor device having a plug electrically connecting two layered interconnection structures such that a neighboring film and a diffusion barrier film are located between the plug and a copper film from one of the interconnection structures, while another diffusion barrier film adjacent to the plug is located between the

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plug and a copper film from the other interconnection structure, wherein the neighboring films have as a primary constituent an element selected from rhodium, ruthenium, iridium, osmium, or platinum and the diffusion barrier films have at least one material selected from titanium nitride, tantalum, and tungsten.

Response to Arguments

9. Applicant's arguments with respect to claims 13-14 have been considered but are moot in view of the new grounds of rejection.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 703-305-0168. The examiner can normally be reached on M-F (8:00am to 4:30pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

SWS
June 23, 2003


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800